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U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY.

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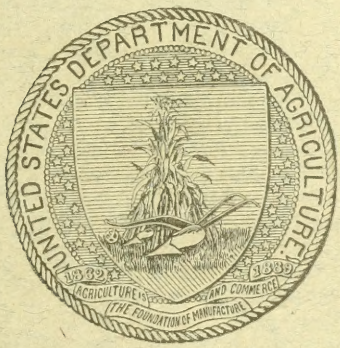
THE CHAYOTE: A TROPICAL VEGETABLE.

BY

O. F. COOK,
Special Agent for Tropical Agriculture.



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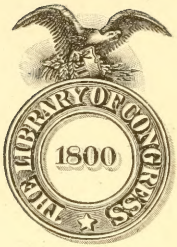

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A CHAYOTE VINE.

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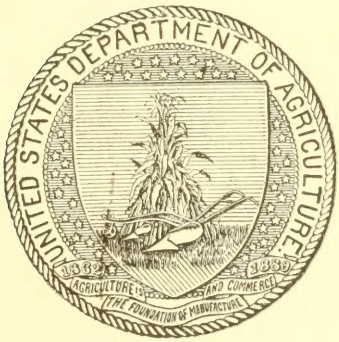

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Botany,
Washington, D. C., May 17, 1901.

Sir: I have the honor to transmit herewith, for publication as Bulletin No. 28 of this Division, a paper by Mr. O. F. Cook, Special Agent for Tropical Agriculture, entitled "The Chayote: a Tropical Vegetable." As far as known, this is the first adequate account of the nature, culture, and economic value of this promising member of the squash family. Although of American origin and long confined to the American tropics, the chayote has recently attained popularity in Australia and Algeria, and from the latter country hundreds of tons of the fruits are now shipped annually to the markets of Paris and London. In Porto Rico the chayote is produced in large quantities for domestic consumption, and no reason is apparent why it may not become an article of export as a winter vegetable for the cities of the United States. It seems, also, to be eminently worthy of cultivation in the Gulf States and California, as well as in Hawaii and the Philippines.

Respectfully,

Frederick V. Coville,
Botanist.

Hon. James Wilson,
Secretary of Agriculture.

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THE CHAYOTE: A TROPICAL VEGETABLE.

INTRODUCTION.

Notwithstanding the proverbial luxuriance of their vegetation and the number and variety of their botanical species, tropical countries are generally deficient in herbaceous or annual food plants corresponding to the garden vegetables of temperate climates. Humid tropical regions are normally covered with dense forests which permit the growth of relatively few herbaceous plants; and of those which maintain an existence under these unfavorable conditions very few have developed characteristics which make them suitable for human food or for cultural propagation. It is in the drier, more elevated, and colder regions that herbaceous plants have really flourished and become diversified; so that, even though belonging to tropical families and having originated in what are commonly deemed tropical countries, many of our useful species do not thrive so well in the moist Tropics as in the temperate regions. This is true, for example, of the melons, squashes, tomatoes, and eggplants, and, in fact, of nearly all the herbaceous food products which can be grown to maturity within the limits of the temperate summer season.

Shrubs or trees and all slower-growing herbs of tropical origin are permanently limited, of course, to winterless countries. To this last category belongs the chayote,[1] for though the perennial root permits the plant to winter through wherever the ground is not frozen, only relatively small crops can be obtained where the growing season is limited by cold weather.

While the chayote undoubtedly suffers under too great moisture and heat, it is obviously more tropical than most garden vegetables; and as its culture is extremely easy and the fruit is an acceptable article of diet, it has important possibilities of usefulness in the agricultural development of many tropical countries. In Porto Rico the chayote (or, as it is there called, the "tayote") stands in quantity and popularity well up in the list of vegetables offered in the markets of all the larger towns. The annual production of the island must have a value of many thousands of dollars, although quite unconsidered as a source of wealth because the consumption is entirely local. And there is every probability that the utility of the chayote may be greatly extended in Porto Rico as well as in the other tropical territory of

[1] Pronounced chī-o'-tay.

the United States and in the warmer parts of California and the Gulf region.

The chayote is a climbing vine belonging to the Cucurbitaceae or gourd family, but to a section different from that which includes the squashes, melons, cucumbers, and other related plants in general cultivation. The fruit of the chayote contains a single, short-lived seed, and it is probably owing to this fact that it is not so well known as its relatives in tropical and semitropical countries. The introduction of a superior variety of a plant already in cultivation is no longer attended with any special difficulty or delay, but new plants are still popularized with extreme slowness until they reach the point of commercial importance. Particularly is this the case when, as with the chayote, the seed can not be kept in stock or handled in large quantities by dealers, who have thus small incentive to advertise or make other special efforts to bring the new plant before the public. The culture of the chayote is extremely easy when once a beginning has been made, and its desirable qualities are such that in spite of the obstacle of a difficult seed supply it has gradually made its way from Mexico through tropical America to Brazil, and is also known at many points in the Old World, from Spain and Algeria to the East Indies and Australia. But this extension of distribution is in many cases of recent date, and the value of the plant is still very imperfectly realized, even among intelligent agriculturists of regions where it is not unknown. In addition to the fruits, which are considered an excellent substitute for the summer squash or the vegetable marrow, though very different from either, the climbing vine is of use as an ornament for covering fences and arbors, the numerous flowers are rich in honey, and the large tuberous perennial roots are charged with starch and furnish a wholesome food material comparable to the true yam.

THE CHAYOTE PLANT.

BOTANICAL CHARACTERS AND AFFINITIES.

The chayote suggests the cucumber rather than any other of the cultivated plants of the same family, but is a larger and more vigorous plant, climbing widely by means of numerous branched tendrils. The leaves are strongly three-angled or lobed, with the broadly cordate base also showing two or four sharp corners. The leaves as they stand in nature (Pl. I) are deeply concave, with the apex sharply decurved. The surface is rather rough, but there are scarcely any hairs, and the color is a deep, fresh green. The whitish veins are rather conspicuous.

The pistillate flowers are solitary, but otherwise not greatly different in general appearance from the much more numerous staminate blossoms. The latter are borne on special branches, which Lowe[1]

[1] A Manual of the Flora of Madeira, p. 292. (London, 1868.)

SECTIONS OF CHAYOTE FRUIT.

describes as "short whorled, long-stalked, axillary racemes," though it is not clear that they are either racemes or whorled, the actual structure, as shown in the illustration, consisting merely of single small clusters at the nodes of a shortened and leafless, but otherwise not greatly modified, branch. Both filaments and styles are connate into a central column, of which the anthers appear as lobes, while the stigmas are more closely set together to form a small head, which Lowe compares to a small fungus.

The ovary is always one-celled, with a single ovule. It is mealy-pubescent when young, becoming spiny with maturity in some varieties. The mature fruits are always more or less compressed, as though built over the large flat seed. They are also, in general, pear-shaped, in that they are narrower near the point of attachment and broader toward the apex, but with many differences of proportion, as shown later in the descriptions of the Porto Rican varieties. In addition to the spines, which, however, are not always present, the surface of the fruit is usually more or less uneven, and has, in addition, several deep longitudinal grooves or channels, more pronounced toward the ends, and in some varieties nearly obliterated near the middle.

The chayote is one of several plants cultivated by the aborigines of tropical America which are not known in the wild state, an indication of the extreme antiquity of agricultural peoples in the Western Hemisphere, whether we believe that culture has so modified the domesticated plants that their generic affinities are no longer apparent or that the wild types have become extinct. In the case of the chayote the derivation from the wild plant named Microsechium by Naudin is perhaps most worthy of consideration, since this genus has a fleshy fruit and tuberous roots. The fruits are, however, very small, and the floral characters are so distinct from those of Sechium that in Engler and Prantl's *Natürlichen Pflanzenfamilien* it is placed at some distance from that genus and is associated instead with Sicyos, to which the external resemblance is very great.

The genus Sechium is treated by all recent botanists as monotypic, containing the single species *S. edule*. Of other names listed under Sechium, *S. americanum* Lamarck and *S. chayota* Hemsley are synonyms of *S. edule*, and the remainder are referred to the genera Cayaponia and Microsechium.

VITALITY OF THE FRUIT.

The fruit of the chayote presents physiological and morphological adaptations apparently unique; it is comparable, perhaps, with that of the mangrove (Rhizophora), though the similarity extends only to the fact that germination may take place before the seed falls from the parent plant. The fruit of the mangrove is adapted for taking

root in the soft mud, into which it penetrates by means of the long, pointed radicle, but in the chayote, which must fall upon drier ground, a projecting radicle would be broken off. Instead, therefore, of putting forth a radicle, the apex of the mature seed is extruded from the fruit only far enough to expose the tip of the hypocotyl, from which arises a tuft of small roots (Pl. II). The plumule escapes laterally from between the cotyledons, which are not further drawn out or separated from the fruit, and the latter, instead of drying up or decaying at maturity, or before the germination of the seed, continues green and fleshy for an indefinite period, doubtless supplying, and perhaps even elaborating, nutriment for the young plant. Lowe says that the fruit, after the germination of the seed, "enlarges into a persistent subaerial rhizome," a morphological impossibility, of course, but a sufficient indication that that talented botanist observed the present anomaly. Relying, perhaps, on Lowe's statement regarding the rhizome, Dr. Morris[1] also appears to have combined the persistent fruit with the tuberous roots. "It is easily propagated," he says, "by planting the whole fruit, which, after germination of the seed, gives rise to a persistent amorphous rhizome of a woody or a fibrous-fleshy character."

The relations between these two features are, however, by no means settled, and the Australian writer who reports in the second season a large tuber "somewhat jelly-like in appearance" seems to afford a suggestion favorable to the opinion that the fruit becomes the "tuber" or "rhizome."

That such an adaptation should arise in the Cucurbitaceae is even more strange than it would have appeared in many other families, owing to the well-known perishability, or at least limited vitality, of the fruits of this group. The chayote constitutes, as it were, the antithesis of the balsam-apple (Momordica), the flesh of which opens and begins to disintegrate, almost by deliquescence, as soon as the apical seeds have matured, and while those at the base of the fruit are still far from ripe.

THE SEED AND GERMINATION.

The chayote further deviates from the normal type of the Cucurbitaceae in its one-seeded character, and in the fact that the seed coats are obsolete or very imperfectly differentiated. At maturity the seed is embedded in the middle of the fruit and entirely enclosed, as shown by the axial section (Pl. III); but before germination the seed grows so that the apex of the cotyledons is pushed farther toward the base of the fruit, while the hypocotyl emerges from the apex and gives rise to several rootlets. As if to permit the seed to grow without pushing itself too far out of the fruit, the tissue about the edges of the

[1] Kew Bulletin of Miscellaneous Information, p. 7, August, 1887.

CHAYOTE FRUITS, ROUND WHITE VARIETY.

cotyledons is very loose and spongy, and in some specimens a cavity is formed. In the middle of the outer faces of the cotyledons, however, there is a considerable surface, representing the original area of the seed, which remains closely in contact with the fleshy and undifferentiated seed coats. It is in this area of the cotyledons, presumably, that the absorption of the nutritive material from the fruit into the seedling takes place. As already noted, the seed coats are undeveloped; but this deficiency is not to be interpreted merely as a failure to supply a protection which is not needed by a seed which never leaves the inclosing fruit. A more direct cause for the deficient seed coats is probably to be found in the fact that firmer and less pervious tissues would interfere with the passage of liquids from the fleshy fruit to the cotyledons.

In the chayote, then, we seem to have a whole fruit functioning as endosperm during an extended period in which it is capable of general vegetative activity. Possibly, however, the nutritive aspect of its utility may be equaled or even exceeded by its importance as a means of storing moisture to assist in carrying the young plant through periods of drought to which the native locality of the species may have been subject. The large tuberous roots which meet this requirement for the more mature plant are said not to be formed until the second season. A third possible advantage also suggests itself; namely, that by being able to send out without delay a vine several feet long, seedlings of the chayote might be able to make connection with the soil without the seed or fruit having come in contact with the ground at all. Such an adaptation would be of obvious utility in permitting a large-fruited species to maintain an existence where the ground is covered with tangled masses of vegetation which in tropical countries often conceal, in turn, a considerable layer of dead sticks and stems. Botanists who have the opportunity of studying the chayote or its near relatives in the wild state, or of experimenting with the germination of their seeds, may accordingly expect to establish the existence of some interesting details of its growth.

It is often forgotten that the keeping qualities of fleshy fruits and vegetables are dependent upon the vitality of the protoplasm of the cells, decay and death being practically synonymous terms in dealing with all such tissues. Many fruits can be kept for considerable periods under favorable conditions and the time can be artificially extended by cold storage. In nature, however, the chayote seems to furnish the only instance of a fruit which normally continues alive after the germination of the contained seed and after separation from the parent plant.

The readiness with which the seed of the chayote germinates will probably be the only obstacle to its exploitation as a commercial product. What determines the germination is not known, and it may be found that if kept sufficiently dry and cool there will be no

difficulty from this source. In Mexico, according to Dr. Edward Palmer, it is considered an easy matter to preserve the fruits indefinitely by packing them in dry sand. It is customary to allow the seeds to germinate before planting, the fruits being placed for this purpose on the shelves of living rooms or in other sheltered places. About New Orleans a similar practice is followed, fruits kept for planting being wrapped in paper and laid away in cool dark cellars or storerooms during the winter. Chayotes shipped from Algeria to the markets of Paris and London are said to bear shipment well, even when eight or ten days on the journey,[1] and to remain for a long time in good condition.

VARIETIES OF THE CHAYOTE.

Two varieties of *Sechium edule*, the one with green and the other with white fruits, are mentioned in various publications. It has also been stated by Lowe that the flowers of the two varieties are colored like the fruits and that the white or cream-colored sorts have both flowers and fruits larger than those of the green. This may be true for Madeira, but in Porto Rico there are several varieties, one of the white kinds being as small as any of the green, but whether floral differences accompany those of the fruit was not ascertained. Neither has the question of the comparative excellence of the varieties been satisfactorily investigated. Most experimenters have had but one or two sorts under observation. Of two varieties grown in Madeira, the cream-colored or white variety is described as larger and "better looking, but not so good" as the light green. Though not mentioned by Lowe, a smooth variety from Madeira has been figured and described by Berkeley.[2]

According to Macfadyen a Jamaican white variety is esteemed "far the more delicate," but there is nothing to indicate that the white fruit of Madeira resembles that of Jamaica in anything except color. In Porto Rico the two colors were about equally represented in the markets, and we heard nothing of a discrimination as to quality, although differences in this regard in all probability exist. There is also nothing to indicate that the above opinions were based on comparative tests which took into account the fact that texture depends largely upon the relative maturity of the fruit.

The fruits are all more or less pear-shaped; one green variety is long and pointed, while a white sort is nearly spherical. The color is green in some varieties and white in others and the larger sorts are twice or three times the size of the smaller. The spines seem to be very variable in size and number, and varietal differences are to be

[1] Dr. L. Trabut, Bulletin Agricole de l'Algerie et de la Tunisie, 15 October, 1900, p. 591.

[2] Gardener's Chronicle and Agricultural Gazette, January 21, 1865, p. 51. From the figure it appears that this sort is similar to the Porto Rican variety here called "Round White." (Pl. V.)

CHAYOTE FRUIT, LONG WHITE VARIETY.

CHAYOTE FRUITS, POINTED GREEN VARIETY.

indicated by form and color rather than by reference to the spines. Thus the writer found in Porto Rican markets at least five varieties of chayote, which may be designated as follows:

Round White.—(Pl. III.) Small, subspherical; the skin white and unusually even; spines obsolete or nearly so.

Long White.—(Pl. IV.) The largest of the Porto Rican varieties, though small fruits are sometimes met with. The shape is oblong-pyriform, with the ridges numerous and very prominent, especially toward the larger (apical) end. The surface is distinctly wrinkled; spines are often present, especially on smaller and broader specimens, the largest and finest examples being generally unarmed. Reduced figures of four fruits of this variety are shown in Pl. VI, three in the upper left-hand and one in the upper right-hand corner.

Pointed Green.—(Pl. V.) A small deep green variety, with the surface finely warted or granulate; smooth or with a few small spines. A majority of the fruits seen had the basal end produced into a long conical or somewhat curved point. The ridges and grooves are less pronounced than in any other sort. The size is smaller than in any except the Round White, and the variety is also readily distinguished from the Broad Green and Oval Green by the narrower outline and the granular surface. Five reduced figures of this variety are shown in Pl. VI, four near the middle of the plate and one at the right.

Broad Green.—Of larger size than the Pointed Green; not pointed at the basal end, but unusually prominent at the apex, thus bringing the greatest diameter only a little beyond the middle. The grooves and ridges are slightly more pronounced than in the Pointed Green, but the general surface is much more uneven and is usually provided with distinct spines, though smooth specimens are not infrequent. The size is exceeded only in exceptional specimens of the Long White. The pronounced thickening about the middle and the subrectangular prominence of the apex are the most characteristic features. Three reduced figures are shown in the lower part of Pl. VI.

Oval Green.—(Pl. VII.) Nearly equal to the Broad Green in size; differing in the oval outline, less narrowed at the ends, and less expanded in the middle. The grooves and ridges are much more pronounced than in the other green varieties. The surface is somewhat granular, but less so than in the Pointed Green. Spines were not observed.

Of the Oval Green variety only smooth fruits were seen, but of all the others both rough and smooth forms were common. Although the spines are weak and fleshy and not able to puncture the skin or cause discomfort in handling the fruit, the smooth varieties are probably more desirable for market cultivation, since the spines are frequently bruised and broken in transportation and thus injure the appearance of the fruit if they do not indirectly induce decay. External bruises discolor more upon the white than upon the green fruits, but, on the other hand, the white chayote in good condition appears more delicate and appetizing than the green, and this superior appearance might easily give it an advantage in the market.

HISTORY AND NAMES.

ORIGIN.

The first European account of the chayote was probably that of Francisco Hernandez, who spent seven years in Mexico in the fifth and

sixth decades of the sixteenth century, and prepared voluminous Latin descriptions of the country, its people, and natural history. An excerpt of the medical plants, edited by Recchus, was published in Rome in 1651,[1] but the note on the chayote was omitted and seems not to have been printed until the issue of the more complete edition of the works of Hernandez, which appeared at Madrid in 1790.[2]

ON THE CHAYOTLI, OR PLANT BEARING FRUIT LIKE HEDGEHOGS.

This is a twining genus common in gardens and cultivated places, and adapted for creeping. It makes a large oval fruit, consisting of a smooth skin and including a sort of acorn, almond, or bean. Stems long, slender, clinging with tendrils; leaves angled at intervals and somewhat similar to those of the grape or the gourd. The fruit is eaten cooked and is everywhere for sale in markets. The interior bean resembles in taste cooked acorns, the rest something marine, such as roasted oysters, although cooked they seem to suggest also sweet potatoes or chestnuts. Neither is there anything at all injurious or unpleasant for food, nor is there any other use accustomed to be made of this plant, as far as I have been able to ascertain. It grows in temperate and warm localities, such as Quauhnahuac.[3]

This statement by one of the earliest and most reliable of the Spanish writers on Mexico establishes the fact that the chayote was in common use and cultivation among the ancient Aztecs. De Candolle seems not to have known of the existence of this edition of Hernandez or he would not have referred in doubtful terms to Seeman's correct statement regarding the origin of the name.[4]

Seeman saw the plant cultivated at Panama, and he adds a remark, important if correct, namely, that the name *chayote*, common in the isthmus, is the corruption of an Aztec word *chayotl*. This is an indication of an ancient existence in Mexico, but I do not find the word in Hernandez, the classic author on the Mexican plants anterior to the Spanish conquest.[5]

During the two centuries in which the account of Hernandez remained in manuscript the chayote was reported by other writers. In 1756 Patrick Browne gives the following account of its cultivation in Jamaica, where it had probably been introduced from Mexico by the Spaniards, though not mentioned by Sloane in 1689:

This plant is now cultivated in many places in *Jamaica*, and grows very luxuriantly in all parts of the island, especially in the cooler mountains, where the vines are always observed to run and spread very much. The fruit is sometimes boiled and served up at table by way of green, in which state it is generally looked upon as wholesome and refreshing, but it is too insipid to be much liked. The apples serve to fatten the hogs in the mountains and inland parts, where the plant is mostly cultivated.[6]

The origin of the West Indian name, "chocho," seems not to have been satisfactorily traced to any aboriginal people, and De Candolle's

[1] Rerum Medicarum Novæ Hispaniæ Thesaurus.
[2] De Historia Plantarum Novæ Hispaniæ.
[3] Op. cit., vol. 1, p. 108.
[4] Botany of the Herald, pp. 73 and 128.
[5] De Candolle, Origin of Cultivated Plants, p. 274. (London, 1886.)
[6] The Civil and Natural History of Jamaica, ed. 2, p. 355. (1789.)

surmise that it may be merely a corruption of the Mexican word is perhaps correct. The exclusive use of the form "tayote" in Porto Rico seems at once an evidence of its foreign origin and of its early introduction, since the aborigines of Porto Rico seem to have been more advanced than those of the neighboring islands and the native names are better preserved.

According to Jacquin[1] the chayote was in daily use on the tables of the Cubans of the eighteenth century as an ingredient in soups, stews, and other dishes. Two varieties were also noted, the more common, about 4 inches long and more or less spiny, being called simply "chayote," while a smooth variety about the size of a hen's egg, and much less commonly grown, was called "chayote frances" or French chayote. Jacquin was of the opinion that the chayote was native as well as generally cultivated in Cuba, but it is not included in Maza's "Flora Cubana," and in that author's "Diccionario Botanico" the name chayote is referred to only in the combinations "Chayote blanco" and "Chayote frances," both of which were said to be applied to the sponge gourd (*Luffa acutangula*), the long, cucumber-like fruit of which could not have been the "Chayote frances" of Jacquin.

DISTRIBUTION.

Ever since the Spaniards and English made the acquaintance of this plant in Mexico and the West Indies its culture has been slowly extending; at present it is known throughout tropical America, and it has long been established in Madeira,[2] where English travelers often have become acquainted with it. The Kew Gardens have within the last two decades sent it to many points in British India and other tropical and subtropical colonies, including St. Helena. It has been known for several decades in gardens in Southern Europe and North Africa. The chayote has also been grown for many years in California, and in a limited area around New Orleans, and efforts were made by this Department in 1899 to introduce it into Florida. It may also be found of use in southern Texas.

In Algeria and Australia the chayote has received recent and very favorable attention, and bids fair to become very soon of recognized commercial importance, and as these are also the most civilized and actively progressive regions into which it has been introduced in the Old World, the suggestion is strengthened that it may be found

[1] Selectarum Stirpium Americanarum Historia, p. 258, *t. 163*. (1763). The plate shows a spiny fruit, proportionally longer and more elliptic than those figured here from Porto Rico.

[2] According to M. Naudin (Revue Horticole, 1886, 16) the chayote has also been introduced into the Azores, whence fruits have been sent to England. Why the plant should become popular in the Portuguese Atlantic islands, and yet remain unknown in the Spanish Canaries, which are in much more direct communication with Mexico and the West Indies, seems not to have been explained.

worthy of serious attention in Porto Rico, where it is already popular as a domestic article of food.

There is also every indication that the chayote would be a valuable accession to the economic plants of Hawaii and the Philippines. Hillebrand's Flora of Hawaii (1888) does not mention the chayote, and the Spaniards are not known to have introduced it into the Philippines, one of several indications that in spite of the formerly extensive intercourse between those islands and Mexico there was no very serious or sustained attempt at plant introduction. Species which could be propagated easily from seed were exchanged; but in many tropical plants the seeds are short-lived, while in others superior varieties can be grown only from cuttings. Only a few of the very numerous East Indian varieties of the banana, for example, appear to have reached Spanish America.

According to Professor Wickson's "California Fruits," the chayote was introduced into California from Samoa and was grown first at Santa Barbara. Apparently the variety differs from that recorded from other parts of the world, since the raw fruits are said to resemble the chestnut in flavor and to attain a weight of "over 3 pounds." The correctness of this reputed origin is also rendered doubtful by the fact that Reinecke[1] does not include Sechium in his list of the plants of Samoa, and that Seeman does not record it from Fiji or from any of the islands of the Pacific. It seems much more probable that the chayote reached California direct from Mexico.

In 1899 an attempt was made by the Department of Agriculture to introduce the chayote into Florida by means of a small number of fruits grown in Algeria and sent from France by Mr. Walter T. Swingle. When these arrived in Washington in January many of the seeds had already sprouted and the remainder were mailed at once to Florida correspondents of the Section of Seed and Plant Introduction. The reports indicate that most of the young plants were killed by the freezing weather of February of that year, and that the few which survived the cold were not sufficiently well established to withstand a period of hot, dry weather which came later in the season. At Miami one plant survived long enough to produce a fruit, but the seed of this failed to germinate. The failure of this experiment seems to indicate that winter and spring are unfavorable seasons for planting the chayote in Florida. Summer or fall planting might afford better conditions, though in a normal season there might have been no serious difficulty with the former importation. It would now be possible to obtain seed from Porto Rico much more quickly than from Algeria, and it seems quite worth while to continue the Florida experiment until decisive results can be obtained. The fact that the chayote grows in Louisiana shows that the heat of Florida is sufficient, though there may be other difficulties of climate or soil.

[1] Dr. F. Reinecke, Die Flora der Samoa-Inseln, Engler's Bot. Jahrb., vol. 23, pp. 237 to 368; vol. 25, pp. 578 to 708 (1898).

CHAYOTE FRUITS, SEVERAL VARIETIES.

COMMON NAMES.

Although not very widely distributed until recent times, the chayote has a considerable number of more or less localized common names. The reason why so many should have been originated is not obvious, unless it be that the necessarily slow and gradual introduction in new communities has permitted the old name to be forgotten before the fruit had obtained standing in the markets and thus required a popular designation. To travelers and residents in tropical countries these local names are not without interest, and a list of those now available is given herewith.

List of common names.

CAHIOTA: Recorded in Lowe's "Flora of Madeira."

CAMOCHAYOTE: A Mexican name for the edible root of the chayote.

CHAHIOTA: Another Madeira name.

CHALLOTE: Recorded by Seeman from the Isthmus of Panama. In a subsequent mention the more correct form, chayote, is used.

CHAYOTA: A West Indian form of the following, used by Jacquin and others.

CHAYOTE: The modern Mexican and now generally preferable name, of which several others are mere corruptions.

CHAYOTE FRANCES: According to Jacquin, this name was applied in Cuba to a small, smooth variety of the chayote, but Maza associates it with the sponge gourd (Luffa).

CHAYOTE PELON: A Mexican name, evidently for a smooth variety, "pelon" meaning "bald."

CHAYOTESTLE: A Mexican name for the edible root of the chayote.

CHAYOTITO: A Mexican name for a variety of chayote (Herrera).

CHAYOTITO GACHUPIN: A Mexican variety of chayote; "gachupin" means "fine" or "elegant."

CHAYOTLI: The ancient Aztec name as recorded by Hernandez in the sixteenth century. The word is said to signify a "head bristling with spines," or a "squash covered with thorns."

CHINCHAYOTE: A Mexican name for the edible root of the chayote.

CHIOTIE: Used in Belt's "Naturalist in Nicaragua."

CHOCHO: The prevalent name in the British West Indies and in Australia.

CHOKO: A Queensland variation of the preceding.

CHOUCHOU: Recorded by Mr. Fairchild as in use among the Creoles of Louisiana.

CHOUCHOUTE: From the French colonies, particularly Reunion; evidently a compromise between the preceding and "chayote."

CHOWCHOW: An English rendering of chouchou.

CHRISTOPHINE: Reported from the French West Indies and from France (Bois).

CHUCHU: The Brazilian name; evidently a further corruption of "chocho."

MIRLITON: In use among the Creole population of Louisiana.

ONE-SEEDED CUCUMBER: Apparently invented by the English-speaking residents of New Orleans.

PEPINELLA: Madeira (Lowe).

TALLOTE: Known only from Porto Rico; evidently an error for the following.

TAYOTE: The Porto Rican modification of the name chayote; apparently indicating that the plant was introduced from Mexico.

UPOPO: A Mexican variety of chayote (Herrera).

VEGETABLE PEAR: British West Indies (Grisebach).

SCIENTIFIC NAME.

The first botanical name known to have been applied to the chayote under the binomial system of nomenclature was *Sicyos edulis*, used by Jacquin[1] in 1760. In 1780 the same author gave the plant recognition as constituting a genus, and called it by the Latinized form of the native name, *Chayota edulis*.[2] Twenty years afterwards Swartz[3] took up the generic name Sechium, proposed by Patrick Browne in 1756,[4] but not employed under the binomial system until the time of Swartz. There appears to be no formulated rule of botanical nomenclature directly calculated to meet such a case. Some botanists would probably hold that the more common use of Swartz's binomial *Sechium edule* should assure it permanent standing; others would restore Jacquin's name as the oldest acceptable binomial designation, while still a third opinion would favor Sechium simply because older as a generic name than Chayota, without regard to the binomial system. In 1763 Adanson[5] had also proposed to replace Brown's name Sechium with the vernacular Chocho, but Chocho has never been used elsewhere as a scientific name or as part of a binomial, and it is scarcely probable that anybody would now wish to take it up.

GROWING AND MARKETING.

CULTIVATION.

When grown under ordinary garden conditions the cultural requirements of the chayote may be said to be two in number: A somewhat sheltered situation and something to climb upon. While the vine will not refuse to grow without these advantages, the results will not be satisfactory. Like many climbing plants, the chayote is very susceptible to injury from the wind, while, unlike many Cucurbitaceae, it does not seem to take kindly to creeping upon the ground, at least in the Tropics. In the different parts of the world the chayote has been found to grow upon a great variety of soils, though it is generally considered to thrive best in a loose sandy or loamy substratum, providing sufficient humus or other fertilizing material be at hand.

Although it has been found possible to secure plants from the seed when planted alone, or even from the embryo when carefully extracted from its seed coats,[6] it is the universal practice to plant the entire

[1] Enum. Pl. Carib., p. 32; Select. Stirp. Am. Hist., p. 258. 1763.

[2] Select. Stirp. Am. Hist., ed. pict., *t. 245* (1780). This binomial was used a second time in 1788 in the Nuremberg edition of Jacquin entitled "Amerikanische Gewächse nach Linneische Ordnung." Pl. 286.

[3] Flora Ind. Occ., vol. 2, p. 1150. 1800.

[4] Civ. and Nat. Hist. Jamaica, p. 355. 1756.

[5] Familles des Plantes, vol. 2, p. 500. 1763.

[6] Dr. L. Trabut, "La Chayote," Alger, 1893, p. 2. The same account is republished in the Bulletin Agricole de l'Algerie et de la Tunisie, 15th Nov., 1900, pp. 617 to 622.

fruit, thus insuring much more rapid and vigorous growth, to say nothing of the advantages of the peculiar adaptation of the fruit to the starting of the plant already described.

In Mexico, according to the information afforded by Herrera,[1] the fruits are harvested in October, well-matured specimens being saved for seed and laid away on shelves, where they soon begin to germinate. Sowing takes place about the beginning of February. Sometimes the seeds are taken out of the fruits and wrapped in hair to protect them from insects. The first fruits are obtained in August; the tubers not until December or January of the second year.

In some localities in British India the chayote has not succeeded well, particularly at low elevations, where the moisture was excessive. It is claimed, however, by Mr. Noch, superintendent of the Hakgala Gardens, that with proper care the vine can be made to thrive even where the natural conditions are unfavorable.[2]

As it is the first that has been grown in this country, it may be useful if I state the best way of cultivating it. It thrives best in a rich, deep, well-drained soil, but may be made to grow anywhere by preparing the site in the following manner: Make a hole 4 or 5 feet in diameter and 18 inches to 3 feet deep, according to the subsoil If the subsoil is good and free you may go to the depth of 3 feet, but if it is clayey or likely to hold water 18 inches will be quite deep enough. Place a layer of rough stones at the bottom of the hole to a depth of 6 to 9 inches for drainage, and over this a few inches deep of small twigs or half-rotted leaves to prevent the fine soil from getting between the stones and choking the drainage. The hole may be filled with the following compost: One-third ordinary garden soil, one-third half-rotted cattle or stable manure (cattle manure preferred for hot sandy soils and stable manure for cold clayey soils), and the remaining third may be formed of leaf mold, sand, wood ashes, lime, and the sweepings of the poultry yard in about equal portions. When the hole has only been taken out about 18 inches deep it will be necessary to raise the soil 18 inches above the ground; indeed, in every case, except in very dry districts, it is best to raise it. The whole fruit, which is set out in a germinated state, must be planted about 3 inches deep in the center of the hole. It begins to grow at once, and in a week or ten days it will have made a good start. It is a creeper, and each plant will require a space of about 20 feet square.

As noted in the discussion of the morphology of the seed it is probable that in nature the fruit normally falls large end down, thus permitting the roots of the seedling to be pushed into the ground, while the young vine issues from between the cotyledons at the side. It is thus not necessary that the fruit should be buried in the earth at all, and in Mexico it seems to be the custom not to plant until after the seed has germinated. No experiments seem to have been made to determine the best method of planting or whether it is desirable for the fruit to be covered with earth or not. Apparently on the analogy of seeds of the other Cucurbitaceae, several writers have advised burying under a shallow layer (2 inches or less) of soil, and this plan

[1] La Naturaleza, vol. 1, p. 236 (1870).

[2] Kew Bulletin of Miscellaneous Information, p. 8, August, 1887.

may have at least the advantage of affording concealment and protection against injury from animals or from other causes.

Although a tropical perennial, the culture of the chayote is by no means limited to frostless regions; it may be grown in the open air wherever the soil is not frozen in winter, and, with protection of the root, even outside the subtropical belt. The vine is sensitive to cold and dies away at the approach of winter, but the reserve material stored in the large fleshy root enables rapid growth to be made as soon as conditions are again favorable. By germinating the seed in a greenhouse or cold frame in March and transplanting when danger of frost is past it is said that good growth can be secured the first season, and thirty fruits or more are sometimes obtained from each vine with five months of favorable weather. Unless such measures are taken to gain time fruiting may be deferred until the second season. It has proved impracticable to raise the chayote in central France, but in the southern part of that country, as well as in Algeria, it is rapidly increasing in popularity.

FREEDOM FROM DISEASES AND INSECTS.

There seems to be no record of the chayote having been affected by any fungous disease or attacked by an insect parasite. It may be that the plant is sufficiently different to be immune from the numerous injuries to which other Cucurbitaceae are subject, and if this proves to be the case the chayote will have a distinct advantage as an exceptionally safe crop.

YIELD AND PRICES.

The chayote has often been described as a vigorous grower and a prolific bearer, but few definite records of production have been published. In New South Wales a vine planted in February commenced flowering in May, but was killed down by cold weather and did not resume growth until August, when it sprouted from the root and by January had covered about 50 feet of a fence 6 feet high. From the end of February to June three or four dozen fruits per week were taken, or about 500 fruits for the season of three months, and this for the first year of bearing. As the perennial root continues to increase in size the plant may well have been larger in subsequent seasons, and one observer claims to have counted 300 fruits on a single vine. At an average of 8 ounces apiece these would weigh 150 pounds, and as this yield is many times repeated, it becomes evident that the chayote is one of the most prolific of herbaceous plants, more than making up in numbers what its fruits lack in size in comparison with the larger Cucurbitaceae.

In Algeria Trabut states the usual yield as from 25 to 100 fruits per plant. He also gives an estimate by Naudin to the effect that a hec-

CHAYOTE FRUITS. OVAL GREEN VARIETY.

tare should under good cultivation produce as many as 120,000 fruits, an equivalent of nearly 50,000 per acre with an average weight of over a pound each. Dr. Trabut also reckons that in the market gardens of Algeria chayotes can be produced profitably at 15 francs per hundred kilos or less than 1½ cents per pound, about equal to the price for which they are sold at retail in the markets of Porto Rico. Packed, shipped, and delivered in the markets of Paris, Algerian chayotes can be furnished all winter at from 30 to 50 francs per hundred kilos, the shipping expenses being very frequently more than the original value of the fruit.

According to Dr. Edward Palmer the chayote is considered a delicacy at Saltillo, Mexico, where on account of frosts it is necessary to protect the roots by extra covering in winter. The market price (5 cents) is accordingly much higher than at Guadalajara and the City of Mexico, where the roots, resembling those of yams and large varieties of cassava, but of better quality, are also commonly on sale. In digging the roots the plants are not destroyed, only one or two of the larger roots being taken at a time. Herrera seems to imply that in Mexico each plant bears annually from 80 to 100 fruits, and from 20 to 25 kilograms of roots, but does not indicate the locality in which the record was made. Belt[1] states that in Nicaragua the chayote vine is very prolific and bears for eight months of the year.

In Louisiana the chayote, or as it is there called, the mirliton, has probably been grown for many years, though its cultivation and use are limited mostly to the creole population of the immediate vicinity of New Orleans and occasional neighbors who have chanced to become acquainted with it. Mr. David G. Fairchild who made inquiries on the subject in December, 1898, found that mirlitons were being sold in the French market of New Orleans at 15 cents apiece, a price which certainly would not be paid were not the chayote considered a table delicacy superior to the vegetable marrow. At any such price the culture of the chayote would certainly be most profitable, even in Louisiana, where only 30 to 35 fruits are expected from each vine. Two varieties are known about New Orleans, a darker and a lighter green; green specimens only were sent to Washington by Mr. Fairchild, and those were much more spiny than any seen in Porto Rico.

At the time of the writer's visit in the latter part of 1899 the chayote was one of the more important vegetables in the markets of the cities of Porto Rico. That it is a staple article which can be produced readily and in any quantity was apparent from the fact that while nearly all other kinds of farm produce were bringing high prices by United States standards three chayote fruits were being sold for 5 centavos, or for a cent apiece in our money. If the New Orleans demand were sufficiently extensive importing chayotes from Porto

[1] Naturalist in Nicaragua, pp. 66, 67.

Rico would be profitable. Such a trade has recently become feasible through the opening of direct communication by steamer from San Juan to New Orleans.

MARKETING THE FRUIT.

As might be inferred from the fact that the fruit of the chayote retains its vitality long after the young plant has germinated, there is likely to be little tendency to decay during transportation if reasonable care be taken. The possible difficulty to be met is rather from the persistent tendency toward germination wherever sufficient moisture and heat are obtainable. The Algerian fruits imported by way of France by this Department showed no signs of decay, but many had germinated, owing to dampness and deficient ventilation of the packages. Under similar conditions almost any other fruit or vegetable would have completely rotted, so that the marketing qualities of the chayote may be expected to prove excellent wherever reasonable precautions are observed. The exceptional vitality of the tissues of the fruit undoubtedly protects them from the attacks of the fungi and bacteria which cause the early decay of fruits and vegetables in transit and storage. It is not impossible, however, that caution may be found necessary in the application of cold storage to the chayote, since if the embryo or even the external cells of the fruit were killed rapid decay might ensue. The fruit of the chayote, though provided with no hard or distinct rind, has a decidedly tough outer layer which gives it considerable protection against accidental injury. Though bruises cause a superficial discoloration they do not seem to be followed by decay, and other wounds seem to heal readily.

USES OF THE CHAYOTE.

THE FRUIT AS HUMAN FOOD.

Of the value of the chayote for food purposes very different opinions have been expressed, some writers reporting it as insipid and scarcely edible, while others have compared it with the vegetable marrow and pronounced it superior. Those who are fond of summer squashes will probably take kindly to the chayote, and others may prefer it on account of its better texture and more delicate flavor. Although firmer than the squash the flesh is not tough or fibrous, and eaten simply with salt and pepper the chayote is an agreeable vegetable. A favorite method of preparing the chayote in Porto Rico is to cut it in halves and boil it, then remove the flesh from the exterior shell and chop it into small pieces with meat and vegetables, including the inevitable garlic or onion and other seasoning. The mixture is then returned to the empty shells and baked. The result is a rich and very palatable dish. With the addition of lime juice and sugar,

or with an admixture of rhubarb or rosella,[1] the stewed flesh is said to form an acceptable substitute for apple sauce; and lime juice is also used with the chayote when employed as a vegetable. In Jamaica the seeds, fried in butter, are also eaten and pronounced "very good," but the writer did not learn that this is customary in Porto Rico. In British India the chayote is said to have become popular as an ingredient of curries. The fruit is, by reason of its comparatively mild but pleasant flavor and good texture, one of those likely to find a place in the cuisine of almost any country, and wide utility as a tropical vegetable seems to be assured.

Mr. W. T. Swingle, agricultural explorer of this Department, finds that considerable quantities of chayotes are now being imported from Algeria to France, where they are largely used in making a substitute for *fonds d' artichaut;* that is, the basal part or fleshy receptacle of the flower head of the true artichoke (*Cynara scolymus*), an article much in demand for special dishes. It has been found that when properly cooked and seasoned the texture and flavor of the chayote permits it to replace the artichoke, if cut into disks so as to give the same external appearance.

CHAYOTE SHOOTS AS A SUBSTITUTE FOR ASPARAGUS.

In Mexico the tender, rapid-growing spring shoots of the chayote are occasionally eaten cooked in the same way as asparagus. Although relished as a delicacy in this form, the plant is considered so valuable for its shade, fruits, and roots that the common people are seldom willing to injure or delay the growth of their vines by the removal of the shoots, the eating of which is thus confined to the haciendas of the more wealthy landowners, some of whom cultivate the chayote on a large scale. The fact that the plant is edible in this form is, however, worthy of notice, and may have importance in connection with

[1] The so-called Jamaica sorrel or rosella hemp is another kitchen-garden plant with which the tropical colonist should not neglect to become acquainted. It has long been cultivated for the sake of its pleasantly acid fleshy calyx both in the East and West Indies. It has attained considerable popularity in Florida, and in Queensland is highly esteemed and extensively cultivated. To quote from Mr. Daniel Jones, of the Queensland Department of Agriculture (Queensland Agricultural Journal, May 1, 1900, pp. 371, 374):

"The rosella (*Hibiscus sabdariffa*) is one of our most valuable fruits, and, from the standpoint of the thrifty housekeeper, few edibles in the range of domestic cookery lend themselves more usefully to the stocking of a housewife's cupboard.

"It is not commonly known that in the utilization of the choko, now fast becoming a popular vegetable, very pleasant tarts can be made by using that vegetable (*Sechium edule*) in conjunction with the rosella. It is well known that many object to what they call the excessive tartness of the rosella. Using it in conjunction with the choko this tartness is modified, and tends to make both these fruits more appetizing. In fact, rosellas are specially adapted for blending with less tart fruit, as they give a flavor to many fruits and vegetables which otherwise would not be acceptable for table use."

the culture of the chayote as a regular market crop, since, if the quality of the shoots is sufficiently high, they will be in demand at special prices wherever there is ready access to tropical cities, in the markets of which asparagus is seldom to be had.

FRUITS AS FODDER.

Since the time of Patrick Browne[1] the value of the chayote fruit as a fattening food for hogs has been recognized in Jamaica, but beyond the fact that it is sometimes planted for this purpose, the extent to which it is utilized for fodder in that island or elsewhere is not known. Notwithstanding the generally high prices of meat the raising of live stock for market usually receives but little attention in tropical countries which do not afford abundance of natural pasturage, to which, when present, no additions are deemed necessary.

VINES FOR FORAGE AND FIBER.

In connection with the use of superfluous fruits and tubers for feeding cattle and hogs, the fact should not be overlooked that the fresh vines and leaves are also relished by live stock, so that no part of the chayote plant need be wasted. Whether it would pay to plant chayotes on a large scale for forage and fodder purposes is not known, but the possibility of thus utilizing the plant and its products would undoubtedly be of incidental importance as a protection against loss to the grower, and affords another reason for believing that the chayote may become recognized as a staple crop in favorable regions of the Tropics.

In Algeria it has been found that the ripened vines of the chayote are sufficiently tough and fibrous to be used for fancy basket work, and in Paris the fibers[2] are woven into ladies' hats, doubtless after special preparation.

USES OF THE ROOT.

In addition to its fruit the chayote produces large tuberous roots. These are said to form in Mexico in the second year, and figure, as well as the fruits, among the farm products commonly sold in the markets. Their popularity is indicated by the existence of several names for the root, as distinguished from the fruit.

The roots of *Sechium edule* produce certain bulky tubers known by the Mexican names chinchayote, chayotestle, and camochayote; the weight is about 3 pounds or under; the form is variable, sometimes subcylindrical, sometimes ovoid or completely irregular. The bark is irregularly cracked, of a dirty yellowish color, and covered with a multitude of small plates separated by shallow cracks; the interior is yellowish white, especially toward the outside.

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[1] See p. 14.

[2] Semler's "Tropische Agrikultur," ed. 2, vol. 2, p. 810 (1900).

In 100 parts of the tubers I have found the following constituents:

	Per cent.
Water	71.00
Starch	20.00
Resinous material soluble in ether	.20
Sugars	.32
Vegetable albumen	.43
Cellulose	5.60
Extracted material, tartrate of potash, chloride of sodium, sulphate of lime, and silica	2.25
Loss	.20
Total	100.00

In separate analyses of different tubers I have obtained as high as 25 per cent of starch in one case and 18 in others, which is easily explainable by the nature of the soil in which the vegetable grew, the time of harvest, etc.

The starch placed in water under the microscope presents the form of lenticular granules, very similar to the starch of wheat, though of greater diameter. Subjected to the action of boiling water it passes readily into a paste. * * *[1]

On account of the ease with which it is digested, Herrera advocates the use of the starch of the chayote as a substitute for arrowroot in feeding children and invalids as well as for general purposes.

Outside Mexico the roots of the chayote appear to have been very little used, and opinions differ greatly regarding their value, probably because experiments were made at different seasons and by different methods. Lowe says that the "rhizome or rootstock" is "large, amorphous, massive; corky rather than fleshy or woody," and says nothing about the root being eaten in Madeira, though the fruit is popular there. Probably his examination was made from old or partly dried roots. In Jamaica it has long been known that the root is edible. It is described by various writers as "farinaceous," and is commonly compared to the true yams (Dioscorea). It may be either boiled or roasted, but there seems to be no account of special methods of cooking or dishes for which it is used.

As with the fruits, any excess of tubers can be utilized as food for stock. There seems to be no record of this having been done anywhere except in Australia; but the resourceful farmers of that country have reported several successful experiments in feeding the roots of the chayote to hogs.

After the second season the root should be carefully removed, when it will be found that a large tuber has been formed, somewhat jelly-like in appearance when cut, which can be utilized either by boiling as a vegetable or fed to pigs, for which purpose it is particularly valuable.

It should not be forgotten that the roots of this plant will shoot out and bear a crop in the second year, and that after this a large tuber will be found underground, which, in addition to being edible in the same way as a yam, is most nutritious food for hogs. The chocho will be found a most satisfactory crop for pig farmers, and can be utilized on all hands to cover unsightly fences and build-

[1] Herrera, La Naturaleza, vol. 1, p. 235 (1870).

ings. Although it gives the best results in the humid atmosphere of our coastal districts it will prove a good crop under irrigation in the easily worked loams of the warm western districts, and will bear fruit nearly all the year round away from the influence of frosts.[1]

But the already noticed Mexican custom of harvesting the tubers without destroying the vine shows that the plant, when once established, enjoys great vitality, and the above suggestion of replanting at the end of the second season seems to indicate that the perennial nature of the species is not adequately understood in New South Wales.

VALUE AS A BEE PLANT.

As in other vegetables of the squash family the stamens and pistils are in separate flowers, pollination taking place through the agency of insects. To attract these the flowers of both kinds, but especially the pistillate, yield abundant nectar, which is secreted in ten glands, two at the base of each of the lobes of the corolla. In most of the countries into which it has been introduced bee keeping has not been a regular industry and the value of the chayote as a source of honey has not been noticed, but the reports of experimenters in New South Wales contain very emphatic statements on the subject:

> When the plant is in flower I have noticed that the vines were swarming with bees, and as flowers are scarce in the autumn the plant will no doubt be valuable as a honey producer.
>
> The plant, which spreads over a large area, commenced flowering at the close of the year, and has been well laden with mellifluous blossoms ever since. The bees are extremely fond of the chocho, and with the apiarist the newly introduced plant must become a strong favorite.[2]

From the photograph of a flowering stem (Pl. II) it will be seen that the chayote differs from many Cucurbitaceae in producing numerous flowers on each fertile branch. It has long been known that the flowers of this family are rich in honey, but from the standpoint of the bee keeper they have been considered of little importance because seldom accessible in sufficient amount, though in the United States fields are recognized as good bee pastures. The chayote seems to make up by numbers what the flowers lack in size, so that the yield of honey may be larger than in related plants. In addition to this there is the fact that Sechium is a perennial bloomer in the Tropics and in the subtropical regions has a very long season. It is thus possible that in regions like parts of Florida, where bee keeping is already an established industry, the honey producing qualities of the chayote may be found of practical account in connection with its other utilities.

[1] Agricultural Gazette of New South Wales, vol. 5, pt. 10, p. 738 (1894).

[2] Agricultural Gazette of New South Wales, vol. 4, pp. 416 to 419 (1893). Several minor notices of the chayote also occur in the same periodical, vol. 2, pp. 117, 654, 1891.

CHAYOTE LEAF AND FLOWERING BRANCH.

THE CHAYOTE AS AN ORNAMENTAL.

In planting the chayote for its fruits and roots it is worth while to consider several minor advantages to be derived from this unusually useful plant. The clusters of small star-shaped white flowers of the chayote (Pl. VIII), though by no means conspicuous are not unpleasing, and are said to have a fragrance resembling that of the peach. The pendant, pear-shaped fruits are also not unsightly; but the vine would scarcely have a claim to be ranked as an ornamental were it not for its vigorous growth and the fresh, clean color and graceful form of its leaves. In shape and texture they suggest somewhat the leaves of the cucumber, and have also been compared to those of the grape; the habit and general effect of the plant are also entirely pleasing, and a New Orleans seed firm includes it among the ornamentals of its catalogue. As already noted, the most conspicuous advantage of the chayote for ornamental purposes is its very rapid and continued growth. A single vine has been described as covering in a few months a fence 6 feet high and 50 feet long, and an even larger space was probably filled in subsequent seasons. As noted among the cultural suggestions, the chayote is not likely to be either ornamental or useful in exposed situations, since strong winds interfere seriously with the growth of the vine; but in yards and other inclosures it will quickly cover fences, sheds, or anything else which it is desired to conceal.

PREPARATION FOR THE TABLE.

STAGE OF GROWTH FOR USE.

As with many other members of the squash family which must be cooked before eating, the young or still immature fruits of the chayote are more delicate in texture and in flavor than the fully ripened. The latter sometimes become tough and stringy, to a degree depending, doubtless, upon the variety and the local conditions. For marketing at a distance it will probably be desirable to permit full size and a reasonable firmness of texture to be reached, but for home consumption, at least, fruits may be selected with reference to the use for which they are intended and according to individual taste in the matter of ripeness.

COOKING.

The simplest method of cooking is to halve or quarter the peeled fruit, boil, and serve with salt and pepper like the summer squash or the vegetable marrow; or, after a preliminary boiling, the pieces may be baked with meat and served like baked potatoes or squash. Some prefer to cut the parboiled fruits into slices, which are then fried. In addition to these simple and direct uses the chayote readily lends itself to the purposes of general cookery, and may be

used not only as a substitute for the squash, but its finer and yet firmer texture will probably render it acceptable to many who do not relish squashes. It should not be forgotten that although the chayote so far resembles the other members of the squash family that for purposes of description it must be compared with them, yet its flavor is quite distinct and much more delicate than that of other vegetables of this kind.

Those who have recently arrived in the Tropics frequently suffer many unnecessary hardships in matters of food because they do not make a serious attempt to understand the nature and methods of preparing the materials available, but look upon the new fruits and vegetables merely as bad or indifferent substitutes for the products of temperate climates. Not many works on tropical cookery are as yet at the disposal of those who desire to take advantage of previous knowledge and experience, and detailed suggestions for preparing the chayote seem to have appeared in but one publication, a copy of which was secured at Kingston, Jamaica, by Mr. David G. Fairchild, agricultural explorer of this Department. Fortunately the chayote, or, as it is there called, the "cho-cho," has received considerable attention, including high commendation of its table qualities, and several useful and suggestive recipes are given, which are reprinted in the following extracts:

JAMAICAN RECIPES.

The cho-cho is a very useful vegetable. It can be cooked in various ways, and the natives are very partial to it, it being, as they say, "so cooling." They often put it in their soups as an addition. Plain boiled with butter or white sauce, it is excellent; mashed with butter and black pepper, it is nice; put in stews, it makes a pleasant variety; and made into boiled or baked puddings with a judicious addition of sugar and lime juice, it so much resembles apple as to deceive one into believing one is eating apple pudding or apple tart. The baked pudding is particularly good.

Cho-cho, stuffed.—Boil two cho-chos with the skin on. When boiled scoop out the insides (cutting the cho-cho the long way). Remove the seeds and pith, pare away the pulp carefully, leaving enough near the rind not to break with it. Mash the pulp with some nicely seasoned fine mince, to which add a little butter and pepper, and pack the mixture into the cho-cho backs or skins. Cover with fine bread crumbs and bake. A nice side dish.

Cho-cho pudding, boiled.—Mix 4 ounces of grated bread, the same quantity of currants, and three tablespoonfuls of sugar together, add the cho-chos (mixed as stated below), and then the well-beaten eggs. Pour into a buttered mold with a cover and boil two hours.

To prepare the cho chos for pudding: Boil two large cho-chos with eight cloves and a small bit of cinnamon till tender. Remove the seeds and strings, after which mash the cho-chos well and squeeze out all the water, which will be plentiful. This will be easily done by putting them into a clean dry cloth and wringing them well. Mix this pulp with a couple of tablespoonfuls of sugar, some grated nutmeg, and the squeezed juice of one lime. It is impossible from the varying sizes of the cho-chos to be perfectly accurate as to the exact proportions of the sugar and lime to be put, but either can be added until you are satisfied as

to the apple taste. Often more of both sugar and lime will be required. The pudding can be eaten hot with sugar sauce or cold with a custard around it.

Cho-cho and ground rice pudding.—Boil four good-sized cho-chos and prepare as for boiled cho-cho pudding. Take a dessert-spoonful of ground rice and boil it with a pint of milk and water. Sweeten when half done, add cinnamon and spice. Beat up one egg well and add to this till it thickens. Put the cho-cho into a pie dish and the custard over it. Grate some nutmeg over the top and bake. Excellent hot or cold.

Tous-les-mois (canna) may be substituted for ground rice if preferred. Make it the same way.

Baked cho-cho pudding.—Four good-sized cho-chos boiled with ten cloves, and mashed and prepared as before, only putting the juice of two limes, one-half pound of sugar, one tablespoonful of butter, and some nutmeg. Put the mixture at the bottom of a well-buttered pie dish and cover it with a pint of grated bread. Beat the yolks of three eggs and one white and add to them half a pint of milk sweetened to taste; pour this over the bread crumbs and bake. When it has "taken color" and is nicely baked remove it from the fire. Then beat the whites of the eggs left over into a stiff froth; add two tablespoonfuls of sugar: when stiff spread over the pudding. Put back into the oven for a couple of minutes to color a pale yellow. It is nice either hot or cold.

Cho-cho tart.—Line the pie dish with pastry [pie crust] and leave some to cover the tart. Take six good-sized cho-chos; pare, core, and boil them with a dozen cloves. When tender slice them, not too thin, and put them at the bottom of the pie; sprinkle them with the sugar, the grated lime peel [of one lime] and the juice [of two limes], then cover with pastry and bake from half an hour to three-quarters. Eaten when cold with a cold boiled custard, it is much more appreciated, but it can be served hot as apple tart.

Cho-cho sauce as a substitute for apple sauce.—Two cho-chos boiled with three or four cloves. When boiled, add two tablespoonfuls of sugar and some lime juice, mashing the cho-chos well first, squeezing out the water and then adding the juice of the lime. Serve with a little butter and pepper stirred in.

Cho-cho seeds on toast.—Remove the seeds without leaving any of the meat or strings round them. Boil these till tender. Put on slices of buttered toast which have a little anchovy spread on them. Pour white sauce over all and serve hot.

Cho-cho savory.—Cut two boiled cho-chos in fingers; put on anchovy toast and pour very hot cocoanut cream over the whole. Serve hot.

Cho-cho fritters.—Boil three large cho-chos with six cloves until tender, remove the seeds and pithy substance inside and mash the pulp. Squeeze it in a clean cloth until as dry as you can get it. Then mix in one egg well beaten, add butter and pepper (and salt to flavor); a teaspoonful of butter will do, and remove the cloves. Make into fritters and fry in lard.

FRENCH METHODS OF PREPARATION.

The popularity of the chayote in France does not depend, however, upon its use in special dishes; it has found a place instead in general cookery. Professor Trabut believes that as soon as its table qualities are known it will become a general favorite, and adds the following suggestions:

Before any special preparation the chayote should be kept in boiling water for about an hour. After this cooking the leathery skin is easily detached; it can be torn off in pieces. The seed is also removed. The vegetable now shows a white flesh like that of a boiled turnip. Cut in slices, it may be prepared with all kinds

of sauces, but it is generally most successful "en gratin" with butter and cheese. In Martinique the flesh from which part of the excess of water has been removed by squeezing in a cloth is mashed (triturée) with bread soaked in milk. This forms a paste (patée) which is very palatable when it is properly seasoned.

The firm flesh of the chayote is cut into artichoke bases (*fonds d'artichaut*), and it fills this rôle sufficiently well.

Slices of the chayote go very well with celery, cauliflower, and kohlrabi. The flexible and fibrous stems are employed in making the finest quality of baskets.

ECONOMIC IMPORTANCE AND COMMERCIAL PROSPECTS.

The question naturally suggests itself whether the chayote may not have a future as an article of export from tropical to temperate regions. While it may be doubtful whether competition with temperate vegetables could be profitably sustained, it seems entirely probable that in the winter and spring the chayote would find ready sale, at least in our city markets, when once it had become known to the American public. The plant is not only perennial, but everbearing, and in connection with a fruit trade or other regular means of communication the shipment of chayotes at the proper season might be found advantageous. At the time of the writer's visit to Porto Rico it seemed to rank among the more important of the fresh vegetables for sale in the markets of the Porto Rican towns. Many Americans had not, however, learned to make use of it and others did not even know its name or nature, but those who had tried it in most cases reported favorably.

Herrera holds that the chayote is one of the most important of the indigenous economic plants of Mexico, and that it is the superior of the potato in the quality and quantity of its products. He also states that its culture is rapidly increasing in Mexico, and believes that it is to become one of the most important of cultivated plants, since it furnishes palatable and wholesome foods which can be produced with extreme cheapness. The single-seeded character of the fruit is a serious impediment to its rapid introduction and multiplication in culture, but it is a significant fact that in all communities where it is known at all it has gradually increased in popularity.

A conspicuous instance of this is to be found in Algeria, where, although introduced as early as 1845, and highly recommended in 1860 by M. Hardy, the director of the experimental garden of Algeria, it has increased in popularity very slowly for many years, and only within the last decade has become a commercial product of serious importance. Dr. Trabut maintains that only exorbitant freight rates stand in the way of the expansion of the chayote industry in Algeria. Even under the present charges hundreds of tons are shipped annually to London and Paris. Very recently (1899) MM. Pailleux and Bois[1] still complain that only the high prices prevent the attainment of wide

[1] Le Potager d'un Curieux, Paris, p. 85 (1899).

popularity by the chayote as a winter vegetable in Paris, and they also advocate its culture on a large scale in Algeria. Its utility as a substitute for the base of the true artichoke in high-priced dishes is a suggestion that it will find other places in the elaborate cuisine of Paris and other large cities of Europe.

Thus with the home demand, the already existing New Orleans market, and the probability that the chayote would find a gradually increasing welcome in the larger American cities, the cultivation of it on a large scale is one of the existing openings for the Porto Rican agriculturist. It should not, however, be forgotten that with this, as with other products, access to permanent markets requires a permanent or regular supply of the article offered; so that the commercial possibilities of the chayote will not be known until it is produced in considerable excess of local demands.

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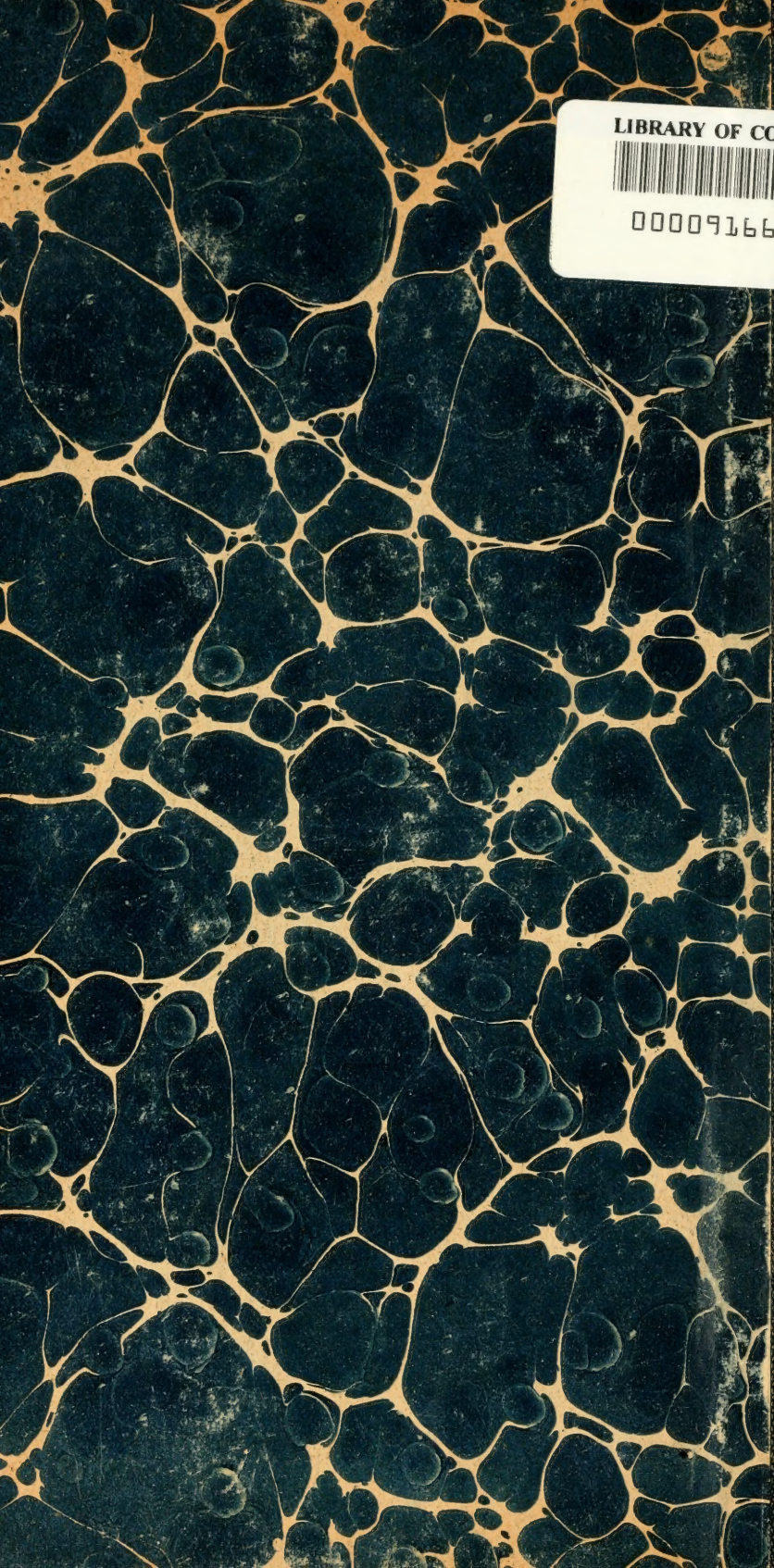
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